

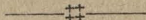
## UNIVERSITY OF CALIFORNIA.

AGRICULTURAL EXPERIMENT STATION. *ca*

BERKELEY, CAL.

*E. W. HILGARD, Director.*

BULLETIN NO. 97.



## INVESTIGATION OF CALIFORNIA PRUNES, APRICOTS AND PEACHES.

The subjects discussed in this paper are summarily set forth in the following quotation from Bulletin 93 of this department:

"The purpose of this work is to show comprehensively the proximate and ash composition of the leading varieties of fruits as grown in the principal fruit regions; and inferentially, the influence exercised upon them by the prominent conditions of soil, climate, fertilizers, etc. The physical data (proportion of pits to flesh, etc.) are of interest from a commercial standpoint, as showing what is being purchased as to available and waste material, etc.

"The consumer, though usually considering fruit as a luxury, would derive much valuable knowledge from studying the fruits in their relative values as foods. The nourishing portions, shown especially by the nitrogenous and saccharine contents, vary greatly with the variety and conditions of growth. It is not, then, a matter of indifference to the consumer what fruit he uses, but an important question of domestic economy.

gen contents of the standard varieties, are of high interest in connection with the vital question of soil exhaustion and fertilization. The soil ingredients extracted by an ordinary crop are a serious drain upon the supporting soil, and the lines of heaviest draft can only become known by the actual determination of the constituents withdrawn."

It will be observed that the majority of the fruits here reported are from the Santa Clara valley, from which they were most readily obtained. It of course intended to extend this work, hereafter, to *all* the fruits grown in California; notably, during the coming season, to all obtainable varieties of figs from the different regions; also, a more numerous representation of apricots, prunes and other plums. It is well known that these fruits differ materially in their qualities *e. g.* as between north and south California, and between the valley and the foothills. These investigations will not only aid in determining the best uses to which

"The ash ingredients, together with the nitro-



these several fruits may be put, but also in what direction and to what extent the soil ingredients taken from the soil by them require replacement. Raisins and table grapes, as well as cherries, pears, etc., will come in their turn in succeeding years. Meanwhile, producers interested in these questions are invited to communicate with the Station in regard to the examination of their fruits.

In the work here presented, as in that previously done on citrus fruits (Bulletin 93), Assistant Colby has been very efficiently assisted by Mr. Hubert P. Dyer, a graduate student in this department.

E. W. HILGARD.

*Berkeley, May 31, 1892.*

#### Description of Prunes, Apricots and Peaches Received.

##### PRUNES.

No. 1, Prune d'Agen, Mountain View—S. F. Leib grower; sample received Sept. 28, '91. Usual size, but more rounded than the other samples of the same variety, quite ripe; soft and very sweet.

No. 2, Prune d'Agen, Niles—Wm. Mortimer, grower; sample received Aug. 26, '91. Condition, good, fully ripe and very sweet.

Nos. 3 to 12, San Jose—John Rock grower. All of these samples, except No. 12 were received, on September 8, '91; No. 12, St. Catherine, came Oct. 3, '91, and represents a fully ripe sample; No. 11, St. Catherine, was rather green. Condition, excellent for all these samples; No. 3, French, No. 7, Hungarian, and No. 10, Datte d'Hongrie, being soft, rather juicy and sweet; No. 7, tasted quite tart; No. 4, Wangenheim; No. 5, Robe de Sergeant; No. 6, Fellenberg; No. 8, Bulgarian, and No. 9, German, were firm-fleshed and much less sweet than the other members of the series.

##### APRICOTS.

Nos. 13 to 18, Niles—James Shinn, grower; samples received during August, 1891. No. 13, Hemskirk, Aug. 3, '91, was hard and unripe. The other varieties, No. 14, Hemskirk, No. 15, Blenheim, No. 16, Royal, No. 17 Peach, and No. 18, Moorpark were in good condition, fully ripe and quite sweet. No. 19, Pringle? Tulare,

grown by B. F. Moore, was received June 30, '91, and has already been reported (Agr. Expt. Stat. Rept., 1890, page 115).

##### PEACHES.

No. 20, Orange Oling, and No. 21, Lemon Cling, samples received Sept. 25, '91, from L. C. McAfee, San Francisco. Condition only fair, as the fruit had been picked for some time. No. 20 was grown by H. M. Alexander, Anderson, Shasta Co.; No. 21 by General Bidwell, Chico.

The table (p. 4-5) shows the results of the analytical work for the season 1891; the first subdivision, A, gives the physical and general proximate analyses; the second, B, the results of the analysis of the ash. Lack of time prevented us from making as extended a work as was desirable upon the ash—that which has been accomplished indicates at least the general character of the ash composition.

The chief points shown by the table will be better understood by a brief discussion as to similarity or difference.

##### Proportion of Pits to Flesh.

*Prunes.*—The range in the percentages of pits is from 3.7, in Hungarian, No. 7, to 7.5 in Robe de Sergeant, No. 5; 5.5 per cent representing the general average, thus leaving about 17 times as much flesh as pits. Thus the consumer finds that, on the whole, the prunes possess but little advantage over each other in regard to the proportion of pits to flesh.

*Apricots.*—Leaving out of consideration the Pringle, No. 19, on account of its small size and relatively slight importance, the variation of pit percentages is from 4.14 (Hemskirk, No. 13) to 6.7 (peach variety No. 17), a somewhat smaller difference than was found in the prunes, viz., 3.8 to 2.5 per cent. The average pit contents is 5.8 per cent, leaving about 16 times more flesh than pits. Here again, there is but a trifling advantage in choice so far as the proportion between flesh and pits is concerned.

For equal weights of prunes and apricots, whole fresh fruit, the consumer receives nearly the same amount of flesh or available matter; but the apricots being



some three times larger than the prunes; we have, on the average, 7 apricots as against 21 prunes to the pound avoirdupois.

*Peaches.*—The limited results obtained prevent us from making any comparisons with the figures presented for apricots and prunes. The difference between the pits in the varieties examined is too small to be considered. Lemon Cling, No. 21, has some 33 times more flesh than pits; Orange Cling, No. 20, shows 25 times more flesh.

European analyses of these fruits report figures which do not differ materially from those furnished in the above table; the average pit percentages for prunes is 5.4, for apricots 5.3, and for peaches 6.1, the weights for whole fruits not being given in the analyses at hand.

#### Proportion of Juice to Flesh.

*Prunes.*—A glance at the figures in the table shows that the French prune, No. 3, has the largest proportion of free juice, namely, 87 per cent, nearly *seven-eighths* of the flesh. No. 5, Robe de Sergeant, falls but slightly below with 84 per cent, or *five-sixths* of the flesh. The driest flesh is that of No. 11, St. Catherine (unripe sample), about *one-half* of it being fiber; No. 12, a later and fully ripe sample of the same name, approaches closely the general average of 73 per cent, or nearly *three-fourths* the flesh. It is important to note that Hungarian, No. 7, while the largest fruit, has nearly ten per cent less juice than the average French prune, *i. e.*, 70 against 80 per cent.

*Apricots.*—The relation between juice and fiber in the flesh is quite constant, as none of the figures obtained differ more than five per cent from the general average (87.3 per cent), the juice amounting to about *seven-eighths* of the flesh, Nos. 16, 17 and 18, respectively Royal, Peach and Moorpark varieties showing the highest proportion of juice (90 per cent), and Hemskirk, No. 13 (not fully ripe), the lowest (82.3 per cent).

The average flesh of the apricots, from this showing, is apparently more juicy than that of the prunes, in the ratio of 7 to 6.

#### Sugar Contents of the Juice, Flesh and Fruit.

The work undertaken this season (1891)

did not comprehend the determination of the different sugars (dextrose, levulose, cane sugar, etc.), contained in prunes and apricots; the length of time necessary to complete such an investigation for each sample required us to limit the work to the determination of the most important point—the total sugars.

*Prunes.*—By far the highest sugar percentages are found in the ripe, soft and juicy French prunes of the various localities; the somewhat harder varieties, Wangenheim, Robe de Sergeant, Fellenberg, Bulgarian, German and Datte de Hongrie yielding, on the average, six per cent less sugar. Although there is a difference of one month in the picking (Sept. 28th to Aug. 26th) of the French prunes from Mountain View and San Jose, yet, for the flesh and fruit, the sugar content is nearly identical, 18.6 per cent for flesh and 17.6 per cent for the entire fruit, fresh. St. Catherine, No. 12, with 22 per cent of sugar in its juice, compares well with the sugar percentage (average 22.6 per cent) in the juice of French prunes; referring these figures to the flesh and fruit, those for the St. Catherine are some 2.5 per cent less on the average. In connection with the St. Catherine, it is interesting to note the wide difference, fully 6.5 per cent, in the sugar found in No. 11 (not fully ripe) and No. 12 (fully ripe) picked over three weeks apart.

Among the other (or) firm-fleshed prunes, the widest difference in sugar percentages is 3.8; Datte de Hongrie, No. 10, showing 12.44 per cent and Wangenheim, No. 4, 8.80 per cent for the whole fruit. A sample of dried French prunes (No. 24) ready for consumption, from same crop as No. 1, Mountain View, and referred to that, yields 47.25 per cent of sugar. This latter figure is a little over four times larger than the general average of sugar in whole fruit of the fresh prunes.

*Apricots.*—Both the early (picked in June) and later varieties (picked in August), with the exception of the (not fully ripe) Hemskirk, No. 13, show a remarkably close resemblance to each other in regard to sugar contents; the Royal, No. 16, with 15.06 per cent, and Peach, No. 17, with



## ANALYSES OF CALIFORNIA PRUNES, APRICOTS AND PEACHES, CROP OF 1891.

## A. — PROXIMATE ANALYSES.

| Name of variety.....                                                     | PRUNES.                |                       |                   |                       |                           |                   |                   |                   |                   |
|--------------------------------------------------------------------------|------------------------|-----------------------|-------------------|-----------------------|---------------------------|-------------------|-------------------|-------------------|-------------------|
|                                                                          | Prune<br>d'Agen.       | Prune<br>d'Agen.      | French.           | Wan-<br>gen-<br>heim. | Robe-<br>de Ser-<br>gent. | Fellen-<br>berg.  | Hunga-<br>rian.   | Bulga-<br>rian.   | Ger-<br>maa.      |
| Number.....                                                              | 1.                     | 2.                    | 3.                | 4.                    | 5.                        | 6.                | 7.                | 8.                | 9.                |
| Place of production.....                                                 | Moun-<br>tain<br>View. | Niles.                | San<br>Jose       | San<br>Jose.          | San<br>Jose.              | San<br>Jose.      | San<br>Jose.      | San<br>Jose.      | San<br>Jose.      |
| Sender or grower.....                                                    | S. F.<br>Leib          | Wm.<br>Morti-<br>mer. | John<br>Rock.     | John<br>Rock.         | John<br>Rock.             | John<br>Rock.     | John<br>Rock.     | John<br>Rock.     | John<br>Rock.     |
| Date of receipt and analysis.....                                        | Sept. 28,<br>1891.     | Aug. 26,<br>1891.     | Sept. 8,<br>1891. | Sept. 8,<br>1891.     | Sept. 8,<br>1891.         | Sept. 8,<br>1891. | Sept. 8,<br>1891. | Sept. 8,<br>1891. | Sept. 8,<br>1891. |
| PHYSICAL ANALYSIS.                                                       |                        |                       |                   |                       |                           |                   |                   |                   |                   |
| Average weight, in grams.†.....                                          | 23.5                   | 22.9                  | 20.8              | 19.5                  | 20.0                      | 26.0              | 80.5              | 25.6              | 25.5              |
| Number per pound.....                                                    | 20.4                   | 20.8                  | 23.0              | 24.6                  | 24.0                      | 18.5              | 6.0               | 13.8              | 13.9              |
| Flesh, per cent.....                                                     | 94.5                   | 94.9                  | 94.24             | 95.0                  | 92.5                      | 94.1              | 96.3              | 93.8              | 93.3              |
| Pits, per cent.....                                                      | 5.5                    | 5.10                  | 5.76              | 5.0                   | 7.5                       | 5.90              | 3.7               | 6.2               | 4.7               |
| FLESH.                                                                   |                        |                       |                   |                       |                           |                   |                   |                   |                   |
| Juice, pressed, per cent.....                                            | 72.6                   | 81.2                  | 86.8              | 69.0                  | 83.8                      | 76.4              | 70.0              | 64.0              | 11.5              |
| Pulp, pressed, per cent.....                                             | 27.4                   | 18.8                  | 13.2              | 31.0                  | 16.2                      | 23.6              | 30.0              | 36.0              | 28.5              |
| JUICE.                                                                   |                        |                       |                   |                       |                           |                   |                   |                   |                   |
| Total sugar by copper (inversion), per cent....                          | 25.6                   | 20.50                 | 21.73             | 13.45                 | 14.00                     | 12.05             | 14.04             | 13.81             | 12.60             |
| Acid, in terms of sulphuric (SO <sub>3</sub> ), per cent....             | .23                    | .24                   | .28               | .52                   | .48                       | .59               | .95               | .50               | .53               |
| SUGAR.                                                                   |                        |                       |                   |                       |                           |                   |                   |                   |                   |
| In fresh flesh, per cent.....                                            | 18.52                  | 16.60                 | 18.87             | 9.26                  | 11.78                     | 9.20              | 11.20             | 8.37              | 9.05              |
| In fresh fruit, per cent.....                                            | 17.50                  | 15.60                 | 17.64             | 8.80                  | 9.89                      | 8.67              | 10.72             | 7.92              | 8.43              |
| NITROGEN.                                                                |                        |                       |                   |                       |                           |                   |                   |                   |                   |
| In whole fresh fruit, per cent.....                                      | .178                   | .145                  | .168              | .140                  | .134                      | .139              | .122              | .121              | .168              |
| In fresh flesh, per cent.....                                            | .148                   | .142                  | .124              | .109                  | .083                      | .117              | .114              | .118              | .150              |
| In fresh pits, per cent.....                                             | .785                   | .641                  | .766              | .588                  | .763                      | .499              | .326              | .514              | .512              |
| Albuminoids in whole fresh fruit (equivalent to nitrogen), per cent..... | 1.112                  | .906                  | 1.050             | .870                  | .837                      | .879              | .762              | .756              | 1.050             |
| ASH (Pure).                                                              |                        |                       |                   |                       |                           |                   |                   |                   |                   |
| In whole fresh fruit, per cent.....                                      | .613                   | .395                  | .442              | .376                  | .361                      | .350              | .392              | .410              | .370              |
| In fresh flesh, per cent.....                                            | .640                   | .387                  | .434              | .365                  | .347                      | .344              | .385              | .404              | .357              |
| In fresh pits, per cent.....                                             | .680                   | .519                  | .582              | .629                  | .627                      | .434              | .416              | .491              | .434              |
| GENERAL PROXIMATE ANALYSIS.                                              |                        |                       |                   |                       |                           |                   |                   |                   |                   |
| Water, per cent.....                                                     | 75.96                  | 79.650                | 77.00             | 79.74                 | 82.50                     | 85.69             | 85.50             | 82.72             | 83.00             |
| Organic matter, per cent.....                                            | 23.43                  | 19.955                | 22.56             | 19.88                 | 17.14                     | 13.96             | 14.11             | 16.87             | 16.63             |
| Ash, per cent.....                                                       | .61                    | .395                  | .44               | .38                   | .36                       | .35               | .39               | .41               | .37               |
| Total.....                                                               | 100.00                 | 100.00                | 100.00            | 100.00                | 100.00                    | 100.00            | 100.00            | 100.00            | 100.00            |

† 30 grams are equivalent to 1 ounce.

## B. — ANALYSIS OF THE ASH.

| FRUIT.           | Place of Production. | Percentage<br>of<br>Pure Ash. | COMPOSITION OF THE PURE ASH. |       |       |
|------------------|----------------------|-------------------------------|------------------------------|-------|-------|
|                  |                      |                               | Potash.                      | Soda. | Lime. |
| FRENCH PRUNES.   |                      |                               |                              |       |       |
| Whole fruit..... | San Jose.            | .442                          | 65.92                        | 3.13  | 3.24  |
| Flesh.....       |                      | .434                          | 69.50                        | 3.07  | 3.01  |
| Pits.....        |                      | .582                          | 24.01                        | 4.53  | 6.04  |
| ROYAL APRICOTS.  |                      |                               |                              |       |       |
| Whole fruit..... | Niles.               | .550                          | 54.88                        | 10.57 | 3.52  |
| Flesh.....       |                      | .542                          | 58.59                        | 11.20 | 3.24  |
| Pits.....        |                      | .681                          | 10.95                        | 3.45  | 6.75  |



## ANALYSES OF CALIFORNIA PRUNES, APRICOTS AND PEACHES—CONTINUED.

## A.—PROXIMATE ANALYSES.

| PRUNES.               |                     |                     | APRICOTS.      |                |                |               |                |                |               | PEACHES              |                     | AVERAGES. |               | DRIED                  |
|-----------------------|---------------------|---------------------|----------------|----------------|----------------|---------------|----------------|----------------|---------------|----------------------|---------------------|-----------|---------------|------------------------|
| Datte d'Hon-<br>grie. | St. Catha-<br>rine. | St. Catha-<br>rine. | Hems-<br>kirk. | Hems-<br>kirk. | Blen-<br>heim. | Royal.        | Peach.         | Moor-<br>park. | Prin-<br>gie? | Or-<br>arge<br>Cling | Lem-<br>on<br>Cling | Prunes.   | Api-<br>cots. | PRUNES.                |
| 10.                   | 11.                 | 12.                 | 13.            | 14.            | 15.            | 16.           | 17.            | 18.            | 19.           | 20.                  | 21.                 | 22.       | 23.           | Prune<br>d'Agon.       |
| San Jose.             | San Jose.           | San Jose.           | Niles.         | Niles.         | Niles.         | Niles.        | Niles.         | Niles.         | Tulare.       | And-<br>erson.       | Chico               |           |               | Moun-<br>tain<br>View. |
| John Rock.            | John Rock.          | John Rock.          | James Shinn.   | James Shinn.   | James Shinn.   | James Shinn.  | James Shinn.   | James Shinn.   | B. F. Moore.  | H. M. Alexander.     | Gen'l Bidwell.      |           |               | S. F. Leib             |
| Oct 3, 1891.          | Sep. 8, 1891.       | Oct. 3, 1891.       | Aug. 3, 1891.  | Aug. 14, 1891. | Aug. 3, 1891.  | Aug. 7, 1891. | Aug. 14, 1891. | Aug. 19, 1891. | June 6, 1891. | Sept. 25, '91.       | Sept. 25, '91.      |           |               | 1891.                  |
| 21.6                  | 20.2                | 18.5                | 89.3           | 63.0           | 81.0           | 46.8          | 57.5           | 59.2           | 24.8          | 153.5                | 215.5               | 27.1      | 36.1          | 10.0                   |
| 22.2                  | 23.7                | 26.0                | 5.1            | 7.1            | 5.6            | 9.6           | 7.8            | 7.6            | 18.0          | 3.1                  | 2.2                 | 20.5      | 7.3           | 48.0                   |
| 94.0                  | 95.1                | 94.8                | 95.86          | 93.98          | 94.75          | 93.40         | 93.30          | 94.0           | 90.90         | 93.9                 | 93.7                | 94.55     | 94.2          | 90.0                   |
| 6.0                   | 4.9                 | 5.2                 | 4.14           | 6.02           | 5.25           | 6.60          | 6.70           | 6.0            | 9.10          | 6.1                  | 6.3                 | 5.45      | 5.8           | 10.0                   |
| 81.7                  | 53.0                | 63.4                | 82.3           | 85.8           | 85.3           | 90.3          | 90.0           | 90.0           | .....         | 79.1                 | 76.2                | 73.3      | 87.3          | .....                  |
| 18.3                  | 47.0                | 30.6                | 17.7           | 14.2           | 14.7           | 9.7           | 10.0           | 10.0           | .....         | 20.9                 | 23.8                | 26.7      | 12.7          | .....                  |
| 16.50                 | 14.32               | 22.00               | 9.01           | 13.43          | 13.43          | 15.06         | 15.72          | 13.58          | 13.50         | 20.0                 | 14.00               | 16.70     | 13.34         | .....                  |
| .38                   | .34                 | .28                 | .....          | .84            | .....          | .46           | .58            | .64            | .....         | .17                  | .32                 | .43       | .63           | .82                    |
| 13.36                 | 8.63                | 15.21               | 7.0            | 11.54          | 11.61          | 13.56         | 13.84          | 12.10          | .....         | 16.00                | 10.80               | 12.30     | 11.56         | .....                  |
| 12.44                 | 8.10                | 14.34               | 6.8            | 10.70          | 11.03          | 12.30         | 12.50          | 11.30          | .....         | 15.00                | 10.00               | 11.65     | 10.76         | .....                  |
| .133                  | .144                | .185                | .....          | .199           | .242           | .258          | .186           | .259           | .....         | .....                | .....               | .148      | .229          | .....                  |
| .104                  | .116                | .150                | .....          | .168           | .210           | .217          | .133           | .224           | .....         | .....                | .....               | .122      | .190          | .....                  |
| .560                  | .751                | .866                | .....          | .784           | .880           | .840          | 1.050          | .805           | .....         | .....                | .....               | .628      | .871          | .....                  |
| .842                  | .900                | 1.156               | .....          | 1.243          | 1.513          | 1.610         | 1.150          | 1.619          | .....         | .....                | .....               | .928      | 1.427         | 3.00                   |
| .333                  | .362                | .440                | .....          | .530           | .555           | .550          | .454           | .494           | .....         | .62                  | .44                 | .403      | .516          | 1.65                   |
| .320                  | .349                | .431                | .....          | .512           | .540           | .542          | .440           | .484           | .....         | .....                | .....               | .395      | .504          | .....                  |
| .405                  | .595                | .526                | .....          | .893           | .850           | .681          | .633           | .612           | .....         | .....                | .....               | .526      | .703          | .....                  |
| 81.40                 | 83.30               | 78.78               | .....          | 84.77          | 84.600         | 85.11         | 85.50          | 85.90          | .....         | 78.50                | 86.50               | 81.29     | 85.57         | 28.00                  |
| 18.27                 | 15.34               | 20.78               | .....          | 14.70          | 14.845         | 14.34         | 14.05          | 13.61          | .....         | 23.88                | 13.06               | 18.31     | 13.91         | 70.35                  |
| .33                   | .36                 | .44                 | .....          | .530           | .555           | .55           | .45            | .49            | .....         | .62                  | .44                 | .40       | .52           | 1.65                   |
| 100.00                | 100.00              | 100.00              | .....          | 100.00         | 100.00         | 100.00        | 100.00         | 100.00         | .....         | 100.00               | 100.00              | 100.00    | 100.00        | 100.00                 |

## B.—ANALYSIS OF THE ASH.

## COMPOSITION OF THE PURE ASH.

| Magnesia. | Peroxide of Iron. | Br. Oxide of Manganese. | Phosphoric Acid. | Sulphuric Acid. | Silica. | Chlorine. | Total. | Less excess of Oxygen, due to Chlorine. | Total. |
|-----------|-------------------|-------------------------|------------------|-----------------|---------|-----------|--------|-----------------------------------------|--------|
| 6.16      | .85               | .31                     | 13.19            | 2.37            | 4.56    | .19       | 99.97  | .05                                     | 99.92  |
| 5.33      | .83               | .17                     | 11.56            | 2.13            | 4.30    | .20       | 100.10 | .05                                     | 100.05 |
| 16.26     | 1.14              | 1.90                    | 32.98            | 5.40            | 7.88    | .22       | 100.16 | .05                                     | 100.11 |
| 3.85      | 1.71              | .21                     | 13.86            | 2.95            | 7.85    | .60       | 100.00 | .15                                     | 99.85  |
| 3.31      | .77               | .09                     | 11.20            | 2.75            | 8.31    | .68       | 100.04 | .14                                     | 99.90  |
| 11.58     | 12.39             | 1.65                    | 43.76            | 5.38            | 2.58    | 1.65      | 100.14 | .40                                     | 99.74  |



15.72, the highest in sugar, showing but about 2 per cent more than the general average, 13.34 per cent, for the juice. Taking the general averages of sugar in the juice of prunes and apricots (columns 22 and 23), we find that the prunes stand a trifle over 3 per cent the higher; for the flesh, and for the whole fruit, the difference is considerably less, viz., about one per cent. Apricots, then, according to these determinations, range much lower in sugar (six per cent) than the Prune d'Agen, the difference being nearly the same as already noted above for the harder prunes.

European reports of these fruits show that the *juice* of prunes, on the average, contains 6.15 per cent sugar, apricots 4.69 per cent (one case is reported of a small variety of apricots with 16.5 per cent sugar), and for peaches 4.48 per cent, these figures being from 2.5 to 3 times less than those herein presented for these fruits as grown in central California. There seems thus to be good cause for the preference they have so quickly attained in the market.

By reference to the small table following the relations to each other of the average *sugar* and *acid* contents of some California fruits will readily be seen. For convenience of comparison the acid is expressed in terms of sulphuric acid ( $\text{SO}_3$ ).

|                                                    | JUICE.          | FLESH.           | WHOLE FRUIT. |       |
|----------------------------------------------------|-----------------|------------------|--------------|-------|
|                                                    | Acid, per cent. | Sugar, Per Cent. |              |       |
| Apricots from Niles.....                           | .63             | 13.34            | 11.56        | 10.76 |
| Prunes from Niles, San Jose and Mt. View..         | .43             | 16.70            | 12.30        | 11.65 |
| French prunes, do. do.                             | .25             | 22.60            | 18.33        | 16.91 |
| Grapes from various localities.....                | .50             | 24.00            | 23.00        | 20.70 |
| Oranges from various localities.....               | 1.34            | 9.65             | 6.20         | 4.70  |
| Peaches from Anderson, Shasta Co., and Chico ..... | .24             | 17.00            | 13.40        | 12.50 |

#### Acid in the Juice.

*Prunes.*—The maximum, nearly one per cent, is at once seen in the Hungarian, No. 10; the minimum, .23 per cent, in the Prune d'Agen, No. 1; the average, .43 per cent, being almost twice the minimum.

*Apricots.*—While the acids differ from .50 per cent to .80 per cent, they do not show as

great a diversity as the prunes in this respect. In both fruits it appears that low acids are combined with high sugars. European analyses, which report the acid in terms of Malic, when corrected for Sulphuric, give for prunes .51 per cent, apricots .70 per cent and peaches .55 per cent, which do not differ much, except for peaches, from those we report.

#### Nutritive Values—Nitrogen Contents.

The flesh-forming ingredients of any article of food being of great importance as regards its proper uses (see Bulletin 93 of the department, relating to oranges and lemons) it is of special interest to compare in this respect the prune and apricot to other fruits, and the different varieties of prunes and apricots amongst themselves. As heretofore set forth in Bulletin 93, the California orange with 1.20 per cent albuminoids, while lower in these ingredients than the Sicilian (albuminoids 1.73 per cent) was rated the *first* in this respect amongst our fruits. In so far as our later work bears in this direction we must accord to the apricot (edible portion alone) an equal place, albuminoids being 1.19 per cent; the prune (.76 albuminoids) takes the *second* place, leaving the other fruits, grapes, bananas, apples and pears (from European data) to stand in the order now mentioned till we find opportunity to study them. The apricot *as a whole* (pits included) shows 1.43 per cent albuminoids, or .23 per cent more than the orange.

Among the *prunes* the highest percentages of albuminoids (.94) is found in the flesh of German, No. 9, and the ripe St. Catherine, No. 12, closely followed by that of the prune d'Agen with .86 per cent; the lowest of the series being the Robe de Sergeant, No. 5 with only .52 per cent—about .2 per cent less than the average for the flesh of all the prunes, which is .76 per cent.

The flesh of the *apricots* shows even a greater difference in albuminoids than the flesh of the prunes, being quite one-half of one per cent; the maximum, 1.37 per cent albuminoids is seen in the Royal, No. 16 and the Moorpark, No. 18; the minimum, .84 per cent, in the peach variety, No. 17,



ranges nearly with the highest albuminoid content in the prunes (.94 per cent).

Apricots grown in Europe average .49 per cent albuminoids, just about one-third as much as the Californian (1.37). European prunes (with .78 per cent albuminoids), however, are more nearly like the Californian (.76 per cent) in this respect.

With this portion of our work we give below a summary of the *food constituents* of some of our *dried* (cured) commercial French prunes, dried apricots and grapes:

|                                                                       | French Prunes.  | Apricots. | Grapes.                                | Apples.     |
|-----------------------------------------------------------------------|-----------------|-----------|----------------------------------------|-------------|
|                                                                       | Dried.          |           |                                        |             |
|                                                                       | Edible portion. |           | Black Mal-<br>vasia, "Grape<br>Food,"* | (European.) |
| Water, per cent .....                                                 | 25.20           | 32.44     | 34.83                                  | 33.00       |
| Ash, per cent .....                                                   | 1.50            | 1.38      | 1.16                                   | 1.40        |
| Albuminoids (Crude Protein), per cent.....                            | 2.70            | 3.27      | 2.94                                   | 1.70        |
| Crude Fiber, per cent.....                                            |                 |           | 3.70                                   | 8.30        |
| Nitrogen — free Extract, per cent .....                               | 29.67           | 31.81     | 2.17                                   | 21.60       |
| Fat, per cent .....                                                   |                 |           | .56                                    |             |
| Sugar, per cent .....                                                 | 40.53           | 29.59     | 52.50                                  | 32.00       |
| Free Acid, Calculated as Sulphuric (SO <sub>3</sub> ), per cent ..... | .40             | 1.51      | .85                                    | 2.00        |
| Tannin, per cent .....                                                |                 |           | 1.29                                   |             |
| Total .....                                                           | 100.00          | 100.00    | 100.00                                 | 100.00      |

\*Dried and ground by R. E. Wood, Rutherford, Napa Co., Cal.

The above results, while inadequate as a basis for general conclusions as to the relative food values of these fruits, nevertheless indicate plainly that the nutrients, notably the sugar and crude protein (albuminoids) differ very widely, *e. g.* the sugar in the grape food is 20 per cent more than that of either the apricot or apple, and 12 per cent more than that in the French prune. Again, the crude protein of the dried apricot is double that of the dried apple, and but one-half a per cent higher than that in the prune and grape. As to ash, we note but little difference.

#### Ash Composition and Nitrogen Contents.

Contrary to statements in our previous publications (Bulletins 88 and 93 of this department), in which, according to European data, the orange stands second (grapes be-

ing first), among fruits in the quantity of mineral matter withdrawn from the soil, we find that, weight for weight, the apricot has the *second* place; and that the prune and the orange have about an equal right to the *third* place, thus again bringing plainly before us the fact that we cannot safely use European results, as heretofore, as a basis of comparison for our fruits.

Upon the basis of the preceding table of this publication and those given in Bulletin 93, we have prepared the following tabular view of the amounts, in pounds, of soil ingredients extracted by the different fruit crops, that will have to be replaced by fertilization:

| FRUITS.                 | Total Ash lbs. | Potash lbs. | Phos. acid lbs. | Nitrogen lbs. |
|-------------------------|----------------|-------------|-----------------|---------------|
| GRAPES.                 |                |             |                 |               |
| <i>European.</i>        |                |             |                 |               |
| In each 1000 lbs.....   | 8.8            | 5.00        | 1.52            | 1.70          |
| APRICOTS.               |                |             |                 |               |
| <i>European.</i>        |                |             |                 |               |
| In each 1000 lbs.....   | 4.90           |             |                 | .86           |
| Crop of 30,000 lbs..... | 147.00         |             |                 | 25.80         |
| <i>California.</i>      |                |             |                 |               |
| In each 1000 lbs .....  | 5.16           | 2.16        | .71             | 2.29          |
| Crop of 30,000 lbs..... | 154.80         | 84.98       | 21.38           | 68.70         |
| PRUNES.                 |                |             |                 |               |
| <i>European.</i>        |                |             |                 |               |
| In each 1000 lbs.....   | 6.3            | 3.73        | .95             | 1.22          |
| Crop of 30,000 lbs..... | 189.00         | 111.90      | 28.53           | 36.60         |
| <i>California.</i>      |                |             |                 |               |
| In each 1000 lbs .....  | 4.03           | 2.653       | .53             | 1.48          |
| Crop of 30,000 lbs..... | 120.90         | 79.70       | 15.95           | 44.40         |
| ORANGES.                |                |             |                 |               |
| <i>European.</i>        |                |             |                 |               |
| In each 1000 lbs.....   | 6.07           | 2.78        | .67             | 2.69          |
| Crop of 20,000 lbs..... | 121.40         | 55.60       | 13.40           | 53.80         |
| <i>California.</i>      |                |             |                 |               |
| In each 1000 lbs.....   | 4.32           | 2.11        | .53             | 1.88          |
| Crop of 20,000 lbs..... | 86.40          | 42.20       | 10.60           | 36.60         |

California prunes thus appear to draw much less upon all the mineral ingredients which have to be replaced by fertilization than the European; the latter, however, draw much more lightly than the former upon nitrogen. *Apricots* both of California and European growth stand, in total amount, about equal as to mineral ingredients withdrawn; as to nitrogen, the California fruit draws 2.5 as much, showing the very material difference in the relative proportions of the vital soil ingredients among themselves.

*Potash.*—In the ashes of prunes and apricots, as in the orange, potash is seen to be the leading ingredient (at least one-half the ash), ranging somewhat higher in the former two fruits. In its distribution as between pits and flesh, the greatest difference



is shown by the European prune; for apricots we have no foreign data. Although potash constitutes so large a portion of the ash of these fruits, its replenishment to the soil will be delayed long beyond the addition of other fertilizing ingredients, because most California soils are naturally so well stocked with it that available potash for the current demand will, in many cases be adequately supplied for many years.

*Phosphoric Acid* is not so heavily drawn upon, nor do our fruits in any case, so far, quite reach the same demand upon the soil in this respect as the European. Its distribution between pits and flesh, also, is not quite so variable as that of potash. Since our soils usually contain a limited supply of phosphoric acid, the prune and apricot as well as the orange orchards will require *phosphatic* fertilizers first, when any are used.

*Nitrogen*.—The apricot here leads in its demand upon the soil in this substance, closely following the European orange. Averaging the nitrogen withdrawn by the prune and apricot, we obtain a figure but slightly greater than that for the orange; emphasizing for those fruits the same necessity of early replacement of nitrogen, and partly for the same reason; viz., that California soils are usually not rich in their natural supply of this substance.

Of the other ash ingredients, it will be seen that *lime* is quite constant, although much less in amount (for prunes) than European standards show. Especially is this difference seen in the comparison of the ash analyses of the flesh and pits. In the orange ash the lime content far exceeds that of either the prune or apricot; accordingly, as our soils generally contain plenty of lime, even for oranges, we would rarely expect to fertilize with a view to its replacement. *Soda* is seen to be much higher here than in European analyses of the ash of the prune; this is probably explained by the fact that California soils, like those of other arid regions, contain much more soda than the European. GEO. E. COLBY.

#### ANNOUNCEMENT.

The Board of Regents of the University has granted Director Hilgard a leave of absence for one year from June 15, 1892, and has appointed E. J. Wickson Acting-Director during the same period.

In this connection, attention is again called to our former request that all letters relating to experimental work, or questions of any kind, should be addressed "*Director of the Station*" as such, and not to individuals, as has been very generally done heretofore.